Case (A) of Middle Meningeal Hem. &c.

I.

A Case of Middle Meningeal Hemorrhage. Operation; Recovery.

An Analysis of Forty-eight Cases of Uncomplicated Intra-cranial Hemorrhage.

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II.

Middle Meningeal Hemorrhage.

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III.

Localized Hemorrhage beneath Pia Mater over Upper Third of Rolandic Area, due to Fall on the Head;

Localized Convulsions without Loss of Consciousness; later, Slight Mental Confusion with Paralysis of the Affected Limbs, followed by Prolonged Coma and Death.

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I.

A CASE OF MIDDLE MENINGEAL HEMORRHAGE. OPERATION; RECOVERY.

AN ANALYSIS OF FORTY-EIGHT CASES OF UNCOMPLICATED INTRA-CRANIAL HEMORRHAGE.

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The patient, a man, was brought to the Massachusetts General Hospital December 27, 1892. Examination found œdema of the right temporal region. Unconsciousness present. An interval of consciousness was absent. Slight bulging of the right eye. (See Case XXIII. of the Extra-dural Group.)

Operation in the right temporal region. A skin-flap was made over the fracture and œdematous area. A fracture was detected running from about the middle of the temporal ridge an inch back of the coronal suture outward and forward across the squamous part of the temporal bone to a half-inch behind the pterion.

The bone anteriorly to the fracture was depressed. The trephine was applied over the depressed portion behind the coronal suture. Upon exposing the dura no pulsation was seen. The dura was dark in color. A slight amount of extra-dural blood escaped. On following the fracture down to the base of the skull the dura was found lacerated, the anterior branch of the middle meningeal artery torn, and blood-clot and lacerated brain-tissue present. The anterior branch of the middle meningeal artery was tied and the hemorrhage ceased. The blood-clots were removed, the exposed area cleansed with boiled water, and gauze drainage introduced. All the gauze was removed in four days. No unusual symptoms attended convalescence. Recovery was complete in three months. (See Fig. 1.)

This case is of interest because no fracture was detected before the operation, and it was supposed that the bulging of the eye indicated an increase of intra-cranial pressure, which proved true.

The method of operating was comparatively simple, in that the fracture was followed down until the bleeding vessel was found. This necessitated the free removal of bone below the trephine-opening.

There was no interval of consciousness in this case, and the conditions found easily explained its absence. The man was suffering from concussion and laceration of the brain as well as from intra-cranial pressure,

and the interval of consciousness was obscured by the presence of the concussion. The recognition of an interval of consciousness, as will be seen by the analysis of the following cases, is of very great importance. If, however, the interval of consciousness is not present, as in the case reported, intra-cranial pressure from hemorrhage cannot be said to be absent, for concussion attendant upon the injury may mask the interval of consciousness which might have been present had the injury been less severe.

FIG. 1.

In this paper an attempt has been made to present for consideration in a concisely accurate form the subject of intra-cranial hemorrhage. The material upon which this study is based has been collected from French, German, and English medical literature covering the period from 1886 (the date of Jacobson's[1] exhaustive study) to September, 1894. Several cases of intra-cranial hemorrhage are here recorded for the first time, occurring at the Massachusetts General Hospital, including the case recorded above, which came under the immediate care of one of the writers, and was the direct stimulus to the present investigation.

It may with truth be said that intra-cranial hemorrhage due to traumatism and all "injuries of the head affecting the brain are difficult of distinction, doubtful in their character, treacherous in

[1] Guy's Hospital Reports, vol. xliii., 1886.

their course, and, for the most part," were formerly "fatal in their results."

To-day, because of a keener interpretation of the nervous symptoms and a knowledge of their localizing significance, because of aseptic methods of operating, and because of the improvement in operative technique, the mortality following intra-cranial hemorrhage is noticeably diminishing.

The importance of this subject is very great. This is shown by the frequency with which cases of this class are overlooked, by the slightness of the violence which produces so fatal an accident, by the suddenness with which death often occurs, and by the very great difficulty of differentiating between symptoms of the lesion under discussion and laceration, and concussion of the brain.

In approaching a case of head-injury the history of the case, including the story of the original violence, is of value. Many head-injuries, which at the time seem simple and unimportant, may prove serious, and may produce ultimately fatal results, as in Cases IX. and III. of Group A, and Cases V. and XXI. of Group B, in which cases the hemorrhage was caused by a blow from a whip-handle, a fall down a few steps, a penknife-wound, and a blow from a billiard cue respectively.

Other cases occur in which the injury is pretty considerable and definitely localized, as in Group A, Cases V. and XV., in which the violence was from the kick of a horse and a blow from a crowbar.

More often the violence is due to falls, and usually to pretty serious falls, as in Group A, Cases XVIII., XX., XXI., and Group B, Case XIX., which were falls down a flight of stairs, or from the top of a freight car, or from one story of a house.

In this series of operated cases there were 27 of extra-dural hemorrhage.

The nature of the injury in these cases:

	Cases.
Falls	18
Blows	4
A pistol-wound	1
Unknown	1
Kicked by a horse	2
Blow with a cricket-ball	1

There were found to be 21 cases of sub-dural hemorrhage.

The nature of the injury in these cases:

	Cases.
Stab-wounds of head	2
Falls, striking on head	11
Blows on head	7
Unknown	1

The sources of intra-cranial hemorrhage which are of practical importance to the surgeon are:

1. From the middle meningeal artery and its branches;
2. From the veins of the pia mater;
3. From the sinuses of the brain;
4. From lacerated brain-tissue.

These four sources of traumatic intra-cranial hemorrhage cannot be easily differentiated clinically. The difficulty of distinguishing hemorrhage from any one of the sources from the associated laceration and concussion of the brain is at times extremely great.

The only very important *general* symptom of intra-cranial hemorrhage, excepting shock, is the interval of consciousness. An interval of consciousness often exists between the time of the injury or stunning of the patient by the accident and the onset of the symptom of compression due to the intra-cranial hemorrhage.

This interval of consciousness is not always present, and it may not be well marked.

In 21 cases of sub-dural hemorrhage here reported the interval of consciousness was present in 9 cases. Its presence was unrecorded in 1 case, and it was absent in 11 cases.

In 27 cases of extra-dural hemorrhage the interval of consciousness was present in 14 cases and absent in 13 cases.

In the sub-dural group the interval of consciousness existed in the following cases: II., IV., VIII., IX., XIII., XVI., XVII., XVIII., and XIX., and a detailed account is here given of these symptoms in each instance.

In Case II., two months after the fall paraplegia and left hemiplegia appeared, and ten days later coma came on rapidly. In this instance the interval of lucidity was an extreme one and was an important factor in the diagnosis of the lesion. It would be interesting to know the pathological condition present which was the occasion of the hemorrhage at so late a date.

In Case IV. there was present a stupid, drowsy condition, which later (after seven days) became unconsciousness. This is not unusual. In place of an interval of clear mental activity drowsiness may precede the coma of great intra-cranial pressure. This should awaken alarm.

Case VIII. illustrates the typical interval of consciousness following a head-injury. A blow on the head; unconsciousness temporary; walks a good distance; becomes stupid or drowsy, and forty-eight hours after the receipt of the injury is semi-conscious; seventy-two hours after the injury is comatose.

Case IX. After a fall, which was forgotten; on the following day was drowsy; drowsiness continued; on the sixth day coma.

Case XIII. was stunned, but recovered consciousness almost immedi-

ately. On the third day after the accident delirium appeared followed by unconsciousness on the fourth day.

Case XVI. The interval of consciousness in this case was not well marked, although present; that is, after an injury unconsciousness existed, and ten hours after the accident the patient became partially conscious. It seems for all practical purposes that the presence of consciousness is relative, but it would be better, perhaps, for purposes of classification to make the distinction a perfectly clear and definite one; either the person is wholly conscious or is unconscious.

Case XVII. At first stupid and dull. This dulness increased up to thirty-six hours after the accident, then for two days there was improvement. He was discharged home, against the advice of his physician, and was returned in four hours comatose.

Case XVIII. An interval of three weeks of consciousness, followed by sudden unconsciousness and associated with general convulsions.

Case XIX. fell; walked home; later there was unconsciousness in varying degree through several days, which, because of its increase, indicated operation.

In the extra-dural group an interval of consciousness existed in the cases numbered III., IV., V., VIII., IX., X., XIV., XV., XVI., XVII., XIX., XX., XXI., and XXVII. In Cases XIX. and XX. the interval of consciousness was only partial. Reference may be had to the individual cases for an account of the symptoms in the extra-dural group.

Taking the two groups together, in the 48 cases of extra and sub-dural hemorrhage, 23 presented an interval of consciousness—that is, nearly one-half of all the cases.

Obviously there must be a large group in which the interval is never present, the concussion caused by the accident passing over into the coma of compression.

The duration of the interval of consciousness may vary from a few minutes to several weeks, as illustrated in the following two cases.

Case XVII., extra-dural group. The patient fell into the water, striking his head on a pile. He walked toward home, and in twenty minutes fell unconscious in a convulsion; spasms began on the left side of the body and appeared later on the right side. There was a scalp wound one and a half inches above the left mastoid process. The bone was not fractured. The breathing was labored. Pulse was about 60. Bleeding from the right nostril. Trephined one and a half inches behind the external angular process of the frontal bone on the right side. Four to six ounces of blood were removed and recovery was complete.

Case II., sub-dural group. A fall; two months later paraplegia followed by left hemiplegia. Ten days later tongue turned to the right. Thickness of speech, involuntary micturition, coma. Trephined over

the right fissure of Rolando. Sub-dural clot found. Gradual and complete recovery.

The duration of the interval of consciousness depends on the number and the size of the vessels bleeding and the rapidity of the hemorrhage. If the patient is kept quiet and no stimulants are given, the hemorrhage will be less severe than if the patient is allowed to move about and freely stimulated.

Case XVII. of the sub-dural group illustrates very well the harm which may come from the patient's moving about. A man knocked down in the street was conscious but dull. At the end of thirty-six hours the stupor increased, but during the next two days the improvement in his mental condition was so great, and there being no localizing symptoms, operation was thought inadvisable. The man left the hospital against advice, and was returned four hours later restless and delirious. There were convulsions of the left arm, head was thrown back, right arm was rigid, respiration was labored and thirty to the minute; right pupil dilated, left contracted. Complete unconsciousness soon appeared, followed by coma and death four days later. [The autopsy is reported with the details of the case.] There can be very little doubt that the moving of this man to his home was the immediate cause of starting up fresh hemorrhage.

It may be impossible to detect the interval of unconsciousness because of the drunkenness of the patient.

Jacobson concludes that the interval of lucidity is absent in one-third of the cases.

Hutchinson says: "It would seem that it is not usual for a large hemorrhage to occur at the time of the injury, for almost always there is an interval during which the patient is well before the symptoms of compression come on."

The interval of consciousness being the only general distinctive symptom of intra-cranial hemorrhage, it is necessary next to inquire as to the local symptoms—and one must consider the condition of the limbs as to hemiplegia, paraplegia, and rigidity; the condition of the pupils, whether they react to light and accommodation, and whether they remain of equal size; the character of the pulse; the character of the respiration; the condition of the scalp; whether, if unconsciousness is present it increases and passes into coma.

In the 48 cases on which this paper is based nervous symptoms were absent in only 5 cases. The variety of cerebral symptoms noted was aphasia, paralysis of one arm, paresis of one leg, paraplegia, spasms of the face and leg, turning of the eyes, spasm of the sterno-mastoid muscle, anæsthesia of different parts, rigidity, general convulsions, ankle-clonus, hemiplegia.

These cerebral symptoms may be well marked; they may be but

little noticed—that is, temporary; certain of them may be more marked in one limb than in the other, or entirely absent.

The condition of the pupils. Nothing new was gained by a study of the pupils in these cases. Jacobson's observations were confirmed. If the pupils are natural as regards reacting to light, the compression of the brain is probably in a recoverable condition if trephining is immediately performed. If the pupils are insensitive and often at the same time dilated, the compression is probably extreme; and while trephining is demanded, it is improbable that the brain in these cases will recover itself after removal of the clot.

The Hutchinson-pupil is of the greatest importance. By this is meant a widely dilated pupil on the side of the injury—*i. e.*, opposite the paralyzed side, the other being natural or contracted. This sign, taken in connection with other evidence, is of supreme value. It indicates pressure on the third cranial nerve, and locates the pressure in the middle fossa.

The pulse. In cases of well-marked compression, uncomplicated, the pulse will be slower than normal and full. In cases of doubtful diagnosis it is important to record the pulse at frequent intervals—*i. e.*, hourly or half-hourly, that any variation may be quickly noted.

Unconsciousness: coma. Where the hemorrhage is rapid and the compression great the coma may be very deep at the outset. The degree and course of the unconsciousness are of importance, for a distinguishing sign of hemorrhage from one of the sinuses is the sudden coma, the pressure being severe. One of Dr. Elliot's cases here tabulated illustrates this point well. The beginning coma must not be taken for a natural sleep.

Respiration. In this group of cases in only nineteen out of forty-eight is there a record of stertorous breathing. The character of the breathing is more often omitted than recorded in the reports of cases. The Cheyne-Stokes breathing is noted in a few cases.

The condition of the scalp and cranial bones. Every patient suffering from so severe a head-injury as to make it probable that trephining is likely to be done should have the head shaved of all hair. This will expose the scalp to good view. Ecchymosis and a feeling of contusion in the scalp—puffy swelling—will suggest an underlying fracture. A progressive intra-cranial hemorrhage may force its way through a fracture in the skull and give rise to a hæmatoma under the scalp.

In a given case of head-injury, having had no regard for the signs above mentioned, there may exist doubt as to the presence or absence of laceration of brain-tissue. The following facts may aid in a definite diagnosis: In middle meningeal hemorrhage the scalp-wound or bruise is usually over the course of the artery. The violence leading to middle meningeal or other hemorrhage may be very slight, as in certain cases already mentioned. An injury causing brain laceration will almost always be severe. If the concussion is severe, the interval of conscious-

ness is apt to be absent. Where the brain is lacerated there are usually present twitchings and spasms of certain groups of muscles.

The treatment is, of course, in these cases trephining and the removal of sufficient bone to enable one to evacuate the blood-clot and arrest the hemorrhage.

If there is fracture present, the trephining should be in the line of fracture. If there be no fracture, the trephining should be, it seems to the writers, according to the rule of Voyt and Beck, at a point one and one-half inches behind the external angular process of the frontal bone, and one and one-half inches above the zygoma, which will locate the anterior branch of the middle meningeal.

Krönlein suggests the advisability of trephining twice, the first point being that suggested by Beck, the second point in Beck's horizontal line below the parietal eminence.

The size of the trephine-opening is determined by the demands of the case. A large trephine will not cut evenly through the bone on account of the curvature of the skull. It is best to use a small inch or inch and a half trephine and enlarge the opening with the rongeur forceps. Whether the dura shall be opened or not is to be decided in each instance on the general principle that it adds little to the risk of the patient, and, if unopened, much valuable information may be lost. The fact should be kept in mind that only in tumors of the brain are there liable to be herniæ cerebri after trephining. Strict asepsis should be maintained, and all the time taken that is absolutely necessary to an aseptic and thorough operation. In children a rapid operation is demanded.

The indications for immediate operation after the reception of an injury to the head are increasing paralysis, thickness of speech, persistent convulsions, an increase in any or all pressure-symptoms—*i. e.*, increasing unconsciousness—the Hutchinson-pupil being an important sign of increasing intra-cranial pressure.

Aphasia points to an involvement of Broca's convolution. Disorders of sight and hearing point to an extension toward the occipital and temporal lobes respectively. Paralysis of the third nerve points to an extension toward the base of the skull.

The mortality after operations on the head for intra-cranial hemorrhage other than cerebral hemorrhage proper has not been determined since 1886.

Jacobson in the cases studied previously to 1886 found that out of 70 cases of extra-dural hemorrhage 13 cases recovered from the operation, a percentage mortality of 81.43, and a percentage recovery of 18.57.

The group of cases here reported enables a fairly just estimate to be formed of the mortality to-day. Since 1886, then, of the 26 operated cases of extra-dural hemorrhage, 18 cases have recovered and 8 have died, a percentage mortality of but 30.77, and a percentage of recov-

ery of 69.23. Of the sub-dural group of 19 operated cases, 15 cases recovered and 4 cases died, showing a mortality of 21.06 per cent. and recovery of 78.94 per cent.

In estimating the value of these figures it must be borne in mind that this is a group of selected cases; many cases have been operated probably which have died and have remained unreported. There must be a very few, on the other hand, which have been operated and recovered, and have been also unreported. These figures represent the mortality and recovery rates of only operated cases—that is, cases in which there have appeared sooner or later definite indications for interference. Of course, of the many unrecovered and unoperated cases there must have been many in which to-day there would have been discovered definite indications for operation. But after taking into consideration just what this group of cases is there represented, the mortality is indeed low, and the percentage of recoveries is very encouraging for operative interference even in pretty doubtful and desperate cases of severe head injury.

SURGICAL ANATOMY OF THE MIDDLE MENINGEAL ARTERY.

Steiner[1] has examined one hundred skulls with reference to this subject, with the following results:

In 57 cases the division of the artery into its anterior and posterior branches took place within the foramen spinosum, so that there was no main trunk of the artery within the skull.

In 35 of the remaining 43 cases the length of the main trunk within the skull was from 1 to 3½ cm. In the remaining 8 cases the length was 3½ to 5 cm.

In 38 cases the course of the anterior branch for a distance of 1 to 3 cm. along the anterior inferior angle of the parietal bone ran through a bony canal—*i. e.*, the vessel was completely surrounded by bone, so that it must necessarily be cut off by the crown of a trephine cutting through the bone at this point.

In 6 cases the anastomosis of the anterior branch with the ophthalmic artery, through the sphenoidal fissure, was so free as to constitute the true origin of the middle meningeal, so that either the posterior branch alone or even no vessel whatever entered the skull through the foramen spinosum, which in these cases may be entirely wanting.

A careful trial of the three recognized methods for locating the anterior branch for purposes of trephining was made with the following results:

Vogt's method locates the artery at the intersection of a vertical line drawn a thumb's breadth back of the frontal process of the malar bone and a horizontal line drawn two-fingers' breadth above the zygoma.

[1] Archiv für klin. Chir., 48 I. 101.

By this method the artery was exactly located in 43 per cent. of the cases. In the majority of the remaining 57 cases the point where these lines crossed lay behind the line of the artery. The point found by this method will vary with the thickness of the thumb and fingers of the operator, as is obvious.

Witherle's method locates the vessel at a point 1½ inches behind the frontal bone, and either one inch above the zygoma or 1½ inches above the articular process of the lower jaw.

By measuring from the upper border of the zygoma Steiner found that by this method he came upon the trunk of the artery in only 28 cases, and that in 65 of the remaining 72 cases the point so located lay from 1 to 2½ cm. behind the actual position of the artery.

Krönlein's method locates the anterior and posterior branches by first drawing a base-line through the lower margin of the orbit and the external auditory meatus. The anterior and posterior branches are both located on a line drawn parallel to this through the superior margin of the orbit, the first at a point 3 to 4 cm. behind the external angular process of the frontal bone, and the second at the intersection of a line drawn vertically from the posterior border of the mastoid process. By this method the anterior branch was located in 53 per cent. of the cases. In most of the remaining cases the artery lay in front of the point located. The anterior branch, or a large secondary branch, was located by this method in only 40 per cent. of the cases. Of these methods, that of Krönlein is certainly the best, since, admitting that an error of 1½ cm. is of no practical importance, the anterior branch will be located with sufficient accuracy in 70 per cent. of the cases.

With reference to the anterior branch, all these methods have the disadvantage of locating the trephine-opening so low as to fall below the course of the artery in all the cases where it takes its origin from the ophthalmic, and accordingly comes in close relation with the outer side of the skull at a somewhat higher point. A second disadvantage is that the artery is found by these methods at the point where it lies in a bony canal (as was found in 38 of the 100 cases), and is consequently liable to be cut off by the trephine.

A disadvantage of Krönlein's method for finding the posterior branch is that the trephine is applied in close relation to the transverse sinus. To obviate these disadvantages the writer suggests that the horizontal line be drawn at a somewhat higher level—namely, from the middle of the glabella.

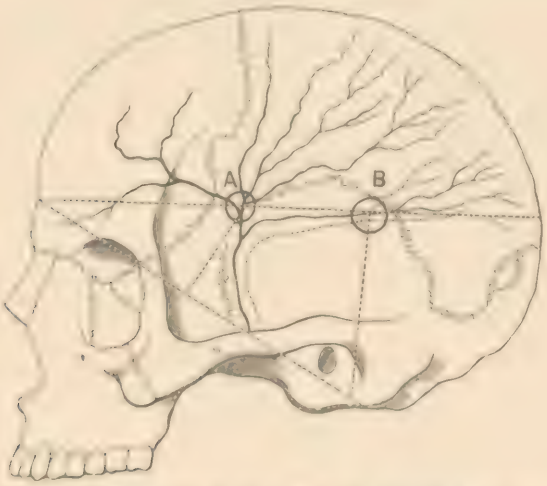
For finding the anterior branch a line is drawn from the glabella to the tip of the mastoid process, and a perpendicular erected at its centre. The intersection of this perpendicular with the horizontal line will give the point for finding the anterior branch.

The posterior branch is found at the intersection of the horizontal line

and a perpendicular drawn just *in front* of the mastoid process. The author claims to have located the anterior branch in 90 per cent.

By this method it is obvious that the trephine-opening for the posterior branch is placed slightly above and in front of the point given by Kronlein's method, and therefore further from the lateral sinus.

FIG. 2.



Method of locating the trephine-opening for finding the branches of the middle meningeal artery. (After STEINER.) A. Point for anterior branch. B. Point for posterior branch.

The writer goes on to state that exact methods of locating the artery are unnecessary in cases where it is possible to remove a flap of skin, muscle, and bone from the side of the skull, with knife and chisel, so as to expose the main trunk and both branches at the same time, either for tying the arteries or removing extravasated blood.

This method of osteoplastic resection is of course inapplicable (*a*) when the soft parts have been torn from the bone by the original injury, or extensively lifted from it by extravasated blood; (*b*) when compound fracture is present. In these classes of cases the exact methods of locating the artery will still be useful.

This method of osteoplastic resection, recommended first by Krause for gaining access to the Gasserian ganglion, was also suggested by him as applicable to injuries of the middle meningeal artery, which is exposed during the greater part of its course.

The flap is described by Krause as follows: "The base of the flap lies above the zygoma just in front of the tragus; the line then runs upward, curving backward at the same time; then describes a semicircle forward and returns to the zygoma, so that the base of the uterus-shaped flap is 3½ cm., height 6½ cm., and its greatest width at the upper part 5½ cm." The writer recommends a similar-shaped but slightly larger flap, the

width and height of which are each about 6 cm., and the width at the base from a thumb's breadth back of the margin of the orbit to the tragus. Near the anterior border of this opening the anterior branch of the artery will be found, and near the posterior border the posterior branch, and easy and free access will be gained to all hæmatomata in the temporal region. If the artery shall be found to have been ruptured still nearer the foramen spinosum, access to it can be gained by chiselling through to the zygoma and breaking off the lowest portion of the lateral wall of the skull. This method is said to have been successfully adopted by Professor Wolfler in two cases.

The following case and pathological specimen, illustrated in Fig. 3, is extremely valuable as demonstrating a local lesion in the middle meningeal artery beneath a fissured fracture of the skull.

FIG. 3.

Ruptured middle meningeal artery. The seat of rupture shows a hair lying in the artery. (Case, Warren Museum, Harvard Medical School, No. 7801.)

A young man was standing on the sidewalk, and was struck in the head by a brick. He fell, striking the sidewalk; recovered in a few minutes and was able to walk to the house of a friend, where symptoms of compression came on, and he died shortly afterward.

At the autopsy made by the medical examiner, Dr. F. A. Harris, of Boston, there was found a slight linear fracture of the skull crossing the course of the middle meningeal artery, which was ruptured. An extensive extravasation of blood had taken place between the dura and the skull. The convolutions were markedly flattened. The specimen is No. 7801 of the collection in the Warren Museum, Harvard Medical School. (See drawing, Fig. 3.)

GROUP OF EXTRA-DURAL HEMORRHAGE CASES.

CASE I. (Krönlein, *Deutsche Zeitschr. für Chirurgie*, 1886.)—A man, thirty years old, fell from a step while drunk, and was unconscious from the time of the injury. Aphasia. Left facial paresis and ocular spasm. Motor paralysis

of the right leg and arm. Could be partially roused. Pupils contracted but react. Pulse 120, of medium strength. Respiration 28 to 30, superficial. Slight excoriation of skin in the left temporal region. On the eighth day stupor increased to coma, and right facial paralysis appeared.

Trephined on the left side over the anterior branch on supra-orbital level, 4 cm. behind external angular process of the frontal bone, and later, over the posterior branch of the middle meningeal. Hæmatoma, 240 grammes, filled the middle fossa and the posterior fossa as far as the occipital protuberance. A fissure was found running vertically downward in the temporal region, cutting off the main trunk of the middle meningeal artery. Answered questions in two days, and paralysis disappeared in three days. Recovery.

Case II. (Krönlein, *Deutsche Zeitschr. für Chirurgie*, 1886.)—A man, aged forty years, fell down some steps, and was unconscious from the time of injury. Moved when loudly spoken to. Three days later pulse 74; less movement of the left arm and leg on needle-puncture than of right arm and leg. Aphasia. Left abducens oculi paresis and nystagmus. Boggy area over right ear and slight tenderness on slight pressure over this same region. On the fifth day was still unconscious and the pulse was 120.

Trephined over the anterior division of the right middle meningeal. Dura punctured. No hæmatoma found. Death in twenty-four hours.

Autopsy. Fracture of the right temporal bone and parieto-occipital hæmatoma reaching forward within 3 cm. of the trephine-opening. A trephine over the posterior branch of the middle meningeal would have exposed this clot.

Case III. (Brunner, *Correspond. für Schweizer Aerzte*, June, 1888.)—A man, aged thirty years, fell from steps and was conscious for four or five hours; later, unconscious. Moved the left leg occasionally. Pulse 50 to 60, full and strong, but intermittent. Respiration stertorous, Cheyne-Stokes. Ecchymosis of the left eyelid. Both pupils were dilated and reacted but weakly. Right facial paresis. Œdema of the scalp in the left temporal region. Slight wound of scalp not reaching to bone. Right hemiparesis and hemianæsthesia.

Trephined over the anterior branch of the left middle meningeal. A fissured fracture running forward and including the groove for the middle meningeal artery was found, an extra-dural hæmatoma 3 cm. thick reaching forward to the frontal bone and toward the median line. Free bleeding from the posterior division and the anterior branch of the middle meningeal, which was checked by three catgut sutures. Hæmatoma, 200 grammes. Condition unchanged by operation. In twenty-four hours moved the right arm. Pulse 86 to 100. In forty-eight hours conscious, and moved right arm and leg. Died on the fifty-eighth day of pneumonia.

Autopsy showed a fracture of the base on the right side.

Case IV. (Davies Colley, *Lancet*, March 31, 1888.)—A man, aged fifty-three years, fell from a height of twelve feet and was stunned, but recovered consciousness, though remaining drowsy. There was paresis of the left arm. The pulse was slow and regular. A bruise was found in the right temporal region. On the eleventh day trephined over the right fissure of Rolando. A large extra-dural hæmatoma was removed. Recovery was complete.

Case V. (Croft, *Lancet*, 1887.)—A woman, aged twenty-six years, was kicked in the head by a horse. There was an interval of consciousness which lasted several hours, when coma ensued. Twelve hours later there was still coma. Complete paralysis of the right arm and leg. A scalp-wound was found just below the left parietal eminence.

Trephined under this wound, and an extradural hæmatoma of two and a half ounces was removed, the hemorrhage being from the posterior branch of the middle meningeal. Moved the right arm and leg in six hours and spoke in two days. Recovered completely.

Case VI. (Walker, *Medical and Surgical Reporter*, 1888.)—A man, aged thirty-five years, history not known. Stupor. Paresis of the left arm and leg and incontinence of urine. Pulse 40. Pupils reacted. On the second day the paresis had become complete and the unconsciousness had increased.

* *

On the fourth day the pulse was 38. There was feeble reaction of the pupils, unconsciousness still existed.

Trephined over the right fissure of Rolando. No fracture of the skull found. Extra-dural clot, four ounces. On the sixth day the patient had so far recovered consciousness as to be able to give the history of having fallen from a scaffold ten feet high. He worked three hours after the fall, walked part of the way home, and fell. Complete recovery in a month.

CASE VII. (Stokes, *British Medical Journal*, 1888.)—A man, aged fifty years, fell from a cart four days before. Insensibility present, which as far as could be ascertained came on immediately; continued upon examination. After four days stupor existed. There were found left brachial motor monoplegia and partial paralysis of the left facial nerve. Barely perceptible insufficiency of the left leg existed. There was a bruise over the upper part of the right fissure of Rolando. This condition of things persisted, and the ninth day the patient became comatose. Swallowed very poorly. Respiration became stertorous, 12, 14, 6 a minute.

Trephined over the bruise on the scalp. A clot was found at the anterior and inferior edge of the trephine-opening. A second opening was made immediately below and in front of the first and a thick clot removed. There was immediate relief, he asking for water, and swallowed it. He moved the left arm and leg while on the operating-table. Complete recovery.

CASE VIII. (Fröhlich, *Münch. med. Wochenschr.*, 1888.)—A boy, aged seventeen years, received a blow on the left parietal region and walked to his home, some distance. In an hour and a half pain and delirium appeared, with vomiting. Stupor was present. He was found by his physician in a dying condition five hours afterward.

Autopsy. A bruise in the left parietal region. No fracture of the skull. Extra-dural hæmatoma from the supra-orbital ridge to the coronal suture. Hemorrhage from the branch of the middle meningeal. Dura was depressed 4 cm.

CASE IX. (Briggs, *Nashville Medical Journal*, xlix. 193.)—A man, aged fifty-one years, had received several blows from the handle of a whip, but walked home. A scalp-wound was found in the right temporo-parietal region. Complete coma in eight hours. Stertorous respiration. Pulse full. Left hemiplegia. Right pupil dilated and did not respond to light. Twenty-three hours later operation.

Trephined. Star-shaped fracture found. Extra-dural clot one inch thick and covering the entire right hemisphere was found. A little bleeding from the exposed small branch of the middle meningeal. Profuse venous bleeding from the right lateral sinuses checked by lateral pressure. Sponges held in place by pressure. Forceps left *in situ*. Patient's condition alarming. Pulse 110. Patient asked for tobacco and answered questions. Sponges removed on second day. Severe hemorrhage checked by gauze tampon. Recovery, with almost complete loss of vision in the right eye and paresis in the left arm.

CASE X. (Calder, *British Medical Journal*, 1889.)—A man, aged twenty-six years, fell down stairs; was unconscious, but recovered consciousness in seven hours. Slight pain behind right ear for five days, then became unconscious again. Sensation and motion of limbs normal. The right pupil a little larger than the left; both reacted. Ptosis of the right eyelid and strabismus of the right eye. Pulse slow, full, and regular. Just above the right ear was found a slight swelling under the skull. Pupils became dilated on sixth day. Pulse 48. Occasionally patient pointed to the swollen spot. On the seventh day unconsciousness deepened; coma at 5 P.M.

Trephined one and a half inches in front of the right ear. A clot was found forming, about an ounce of blood on the surface of the dura and adhering to it. In the evening the pulse rose to 80 and consciousness was completely restored. Ptosis and squint disappeared on the fourth day. Discharged in one month, well.

CASE XI. (Deaver, *Journal of Nervous and Mental Disease*, 1890.)—A man, aged twenty years, received a pistol-wound in the left temporal region. Conscious. No symptoms. Next day aphasia.

Trephined over the lower end of the left fissure of Rolando. Bullet imbedded in the skull and fracture of the inner table. No depression. Extra-dural clot. Hemorrhage from the posterior branch of the middle meningeal. Complete and quick recovery.

Case XII. (Deaver, *Journal of Nervous and Mental Disease*, 1890.)—A man, aged thirty-four years, fell twenty feet down a hatchway. A scalp-wound over the right parietal eminence. Respiration 14, temperature 97°. Conscious, but a little dull. In an hour and a half restlessness, twitching of the right leg, arm, and face, respiration labored, then in half an hour convulsions of the right side, becoming rapidly general.

Trephined four hours later under the wound, but no fracture was found. Four ounces of extra-dural clot. Death from shock.

Autopsy. A fissured fracture of the left parietal bone, starting immediately below the trephine opening and extending to the base of the skull.

Case XIII. (Deaver, *Journal of Nervous and Mental Disease*, 1890.)—A man, aged twenty-three years, fell fifteen feet, striking on his head. Complete unconsciousness. Pupils reacted, respiration 24, and pulse 100. Scalp boggy over the whole of the left side and vertex. Partial consciousness returned in twenty minutes. Epileptiform convulsions, breathing embarrassed, pulse full and strong. Cyanosis. Respiration slow, deep, and stertorous. Pulse slow and full. Right side slightly spastic, left side paretic.

On raising the scalp there was found a fissured fracture on the left side following the coronal suture. Trephined over the lower end of the fissure of Rolando. Anterior branch of the middle meningeal ligated. Bleeding continued, and a ligature was placed on the posterior branch of the middle meningeal. Four hours after partly rational. Six hours after, pulse 96, respiration 28. Recovery complete. Two slight convulsions on the second day.

Case XIV. (Ransohoff, *Annals of Surgery*, 1890.)—A man, aged twenty-eight years, a merchant, fell eight feet from a ladder. No unconsciousness and no symptoms. He went about his business. Eight days later headache and unconsciousness. In three hours stertorous respiration, pulse 40 and full. Coma. No conjunctival reflex. Twitching movements of the face and both sides of the body. No paralysis. Right pupil contracted, sluggish. Left pupil dilated unduly and fixed. No evidence of traumatism on head. Urine, specific gravity 1040 and contained sugar. Temperature 107°. Stertor and coma. Paresis.

Trephined over the left temporal bone two inches above the external angular process, and six ounces of extra-dural clot removed through the opening, 1 x 2 inches. All hemorrhage ceased on the removal of the clot. Pulse was 140, and collapse supervened. Next day consciousness returned. Hemorrhage on the ninth day; recurred on the tenth in spite of packing, and the source could not be found.

Ligation of the carotid artery, septic course of wound, and death on the fifteenth day from hemorrhage from carotid. Urine normal twelve hours after the operation.

Case XV. (Ghent, *Gaillard's Med. Journal*, August, 1891.)—Blow from a crowbar over the right parietal bone. Unconscious for twenty minutes, then recovered and walked 300 yards. Conscious for five hours, and then unconscious. Pupils dilated, respiration heavy and stertorous. No movements on the left side. Fifth day unconscious, pulse 46, respiration slow, involuntary micturition and defecation.

Trephined over parietal bone in the wound. No fracture or depression. One and one-half ounces of extra-dural blood clot removed. On rousing from chloroform spoke and recognized friends. Moved the left arm and leg on the day after operation. Recovery complete, though delayed by suppuration.

Case XVI. (Redman, *Medical News*, 1891.)—Conscious for half an hour, climbed a fence and walked home, fifty yards. One and one-half hours later unconscious; pupils widely dilated, no reaction; pulse 120, wiry; respiration labored and becoming stertorous. Vomiting every few minutes. Involuntary micturition. Head held slightly to the left side. Twitching of the right arm and leg. Rhythmic clonic spasms of right arm. Scalp-wound on the

right side, horseshoe-shaped and four inches long, its centre being about a quarter of an inch above the right eye. A fissured fracture of the frontal bone one and one-half inches long.

Trephined on the right side three hours after the injury; the inner table was found depressed. An extra-dural clot three inches in diameter removed. Patient could talk on coming out of chloroform. Catgut drainage. Rapid and complete recovery.

Case XVII. (Stewart, *Edinburgh Medical Journal*, December, 1891.)—Fell into the water, striking his head on a pile. Walked toward home, and in twenty minutes fell unconscious in a convulsion. Spasms began on the left side of the body, and appeared later on the right side. A scalp-wound one and a half inches above the left mastoid process. Bone not fractured; breathing oppressed; pulse about 60, and slightly irregular; bleeding from the right nostril.

Trephined one and a half inches behind the external angular process of the zygoma on the right side. From four to six ounces of blood were removed. Dura mater flapped with each inspiration. Next morning the patient wanted to go to work. Recovery complete in three months. Interrupted in three weeks by a rise of temperature to 103.6°.

Case XVIII. (McCosh, *New York Medical Record*, 1892.)—A boy, aged seven years, fell down stairs. Semi-comatose for twenty-four hours. On the third day stupor lessened. Legs drawn up; aphasia. On the sixth day paresis of the left upper extremity. On the seventh day paresis of the left leg and face. Convulsive movements on the left side, and finally complete hemiplegia.

On the eighth day trephined just in front of the right fissure of Rolando. Extra-dural clot found over the centre of the Rolandic fissure. Dura torn. Moved leg and arm on coming out of chloroform. Recovery complete, without convulsions.

Case XIX. (J. W. Elliott, *International Medical Magazine*, 1893.)—A boy, sixteen years old, fell twelve feet. A small scalp-wound existed near the right parietal eminence. Stunned; regained partial consciousness; could be roused. Pulse 68, strong; respiration 20, and quiet. Hemorrhage from right ear. No paralysis, but slower response on the left side. Knee-jerk greater on the left side. In about two hours could not be roused. Pupils dilated, right more than left, and neither responded. Pulse 42; stertor, soon becoming coma. Respiration 28; pulse 40. The right pupil unduly dilated.

Operation. No depression. Trephined one-half inch above the zygoma over point of the right middle meningeal artery. Found a large extra-dural hæmatoma. Branch of the anterior division of the middle meningeal torn and bleeding. Opening enlarged upward and backward. Brain depressed one inch. Considerable hemorrhage from the dura checked by gauze tampon. Pulse 100; respiration slow and stertorous. Consciousness returned on the second day. Recovery complete in three months.

Case XX. (Elliot, *Massachusetts General Hospital Records*, vol. cclxxvii. p. 82.)—A man, aged twenty-seven years, fell from a freight car. Nine hours later semi-conscious; pulse 100, and weak; pupils were equal and reacted. Œdema over the right temporal region and a small wound of the occipital region. Twenty-four hours later unconsciousness complete; no movement of the legs. Fracture of the spine in the lower dorsal region discovered. Pulse 88. Œdema of scalp increased. In forty-eight hours cyanotic. Scalp tense and very œdematous.

Trephined over the upper part of the right parietal bone, and a fracture found. Fissure running forward and backward continuous with the coronal suture, which was split open. About three drachms of extra-dural clot and hemorrhage from the longitudinal sinus. Pulse rose to 150 and the cyanosis disappeared. Answered questions the evening of the operation. In twenty-four hours right facial paralysis. In forty-eight hours restless and delirious. Death on the fifth day.

Case XXI. (Elliot, *Massachusetts General Hospital Records*, vol. cclxxvii. p. 69.)—A man, aged forty years, fell from a freight-car and walked a short dis-

tance. Partially conscious. Pulse 48 to 60, tense and full. Left pupil dilated and reacted slightly; right pupil normal. No paralysis. Stellate wound before and behind left parietal eminence. Slight bleeding from the left ear. Occasional twitching of the right arm and shoulder. Respiration 24, natural. Wound enlarged and no fracture found. Pulse remained about 64. In the evening grew slightly more unconscious.

Trephined six hours later in the centre of the wound. Dura was tense, bulging, and non pulsating. Dura was incised. A slight amount of clotted blood oozed out, and the lacerated brain protruded. No fracture was found. Symptoms seemed due to laceration of the brain-tissue. Dressed, with drainage. Pulse rose to 100, and varied between 70 and 100 during the night; breathed with regularity. Seven hours after operation twitching of the left arm and shoulder. Twelve hours later the right pupil was unduly dilated and convulsions were present. Cyanosis, stertor, rapid respiration, rising pulse, and death sixteen hours later.

Autopsy. Fissured fracture starting just below trephine-opening downward and forward across parietal and squamous portion of the temporal bone just in front of the external auditory meatus, lacerating the middle meningeal artery. A blood clot, about five ounces, lying partly in the middle and partly in the posterior fossa of the skull depressed the dura about an inch. The dura was intact.

Case XXII. (C. B. Porter, *Massachusetts General Hospital Records*, vol. cclxxvii. p. 19.)—A man, aged thirty three years, fell down an elevator-well two flights, and was immediately unconscious. In half an hour stertorous breathing was present, but he could be partially roused. Pupils were equal and reacted alike. A slight scalp-wound was found just to the right of the sagittal suture on the biauricular line. Six hours later the left pupil was contracted and fixed, and the right was dilated and fixed. Paralysis of the left side. Complete unconsciousness. Pulse rose to 180. Operation nine hours later.

On clearing the skull, a crack was seen running downward and toward the lambdoid suture, which was somewhat separated. The superior longitudinal sinus was found to have been torn. Sutures were passed beneath the sinuses with curved needles, and packing with gauze controlled the hemorrhage. Death on the table. Dura was found torn, and the brain was lacerated extensively.

Case XXIII. (Scudder, *Massachusetts General Hospital Records*, vol. cclxxv. p. 205.)—A man, aged thirty-two years, fell from a freight car. Unconscious. No interval of consciousness. Pulse 64, high tension; respiration 32, and stertorous. Pupils equal but contracted, and did not react. Œdema of right temporal region. Right eye bulged slightly, and the right upper eyelid was ecchymosed. No fracture of the skull detected. Moved arms and groaned when temporal region was pressed upon, and showed after two hours partial return to consciousness.

Operation in the right temporal region, and a fissured fracture found running to the base of the temporal fossa parallel to and just one inch behind the coronal suture. A slight depression on the anterior edge just behind and above the external angular process.

Trephined just in front of the fissure. Dura non-pulsating, dark in color, and rather tense. A little extra-dural blood removed (three or four drachms). Hemorrhage from the middle branch of the meningeal found by enlarging the opening downward and backward and the artery tied. The dura was torn along the lower portion of the fissure. A little lacerated brain-substance escaped. Gauze drain. Pulse fell during the night to 114. Roused by pressure on the third day. Conscious on the third day. Recovery complete in three months.

Case XXIV. (*Massachusetts General Hospital Records*, vol. cclxxi. p. 186.)—Male. Fell from a freight-car. Bruise on the right side of the head. Pupils contracted and reacted but slowly. Pulse 84. In four hours convulsive movements of right face, passing to the left side of the body. Six hours later the pulse grew more rapid (160), short and weak. Stertorous respiration. Movements of the left arm after twenty-one hours.

Trephined over the left fissure of Rolando. Hæmatoma, intra- and extra-dural. Brain lacerated. Fissure of the skull directly across the vault. Death in two hours.

CASE XXV. (Park, *Medical News*, Philadelphia, December 3, 1892.)—A boy, aged fifteen years, was struck on the right side of the head by a wagon. Bruise and ecchymosis. No wound. Six days later there were no motor symptoms, but he was feverish and restless, with a rising temperature. Flattened and depressed area of skull felt back of the right parietal eminence. Linear V-shaped fissure with depression found above the right ear.

Trephined 5 cm. above the right ear, and found an extra-dural clot beginning to be organized, 10 by 6 cm. and 1½ cm. deep at the deepest portion. Recovery.

CASE XXVI. (Packard, *Medical News*, Philadelphia, 1894, p 45.)—A man, aged twenty-seven years, fell from a wagon. Points of ecchymosis over the right parietal bone one inch from the median line. Œdema and tenderness on pressure. Patient dull and stupid.

Exploratory trephine over the right parietal bone under tender area. One ounce of extra-dural clot. No symptoms. Recovery.

CASE XXVII. (Harlam, London *Lancet*, February 24, 1894.)—A left-handed boy, aged sixteen years, received a blow above the right ear with a cricket-ball. He was dizzy, but continued to play for a while, and walked home, a few hundred yards. The accident was at 5 P.M., and he got home about 6 P.M. He soon felt sick and became semi-comatose. At 8 P.M. unconsciousness, stertor, pupils equal and reacting. Pulse slow and full; temperature subnormal. No paralysis. Three days later paralysis began in the left leg and spread to left upper extremity and side of face. Four days later more marked paralysis and reflexes absent. Anæsthesia over the paralyzed area. Pulse slower. Five days later unconsciousness less marked, but paralysis the same. Scalp showed slight abrasion at the top of the right ear.

Trephined one and a quarter inches above the right auricle. No fracture or clot. Second opening above and slightly in front of the first. A little blood from the upper posterior side. Third opening above and behind second. No clot. Hemorrhage from smaller branches of the posterior division of the middle meningeal diagnosticated. Thought best not to search further, but rely on having relieved the pressure. No drainage. In examining the third button of bone a fissured fracture of the internal table was found. Convalescence was slow, interrupted by the formation of a hæmatoma. Complete recovery in five months.

GROUP OF SUB-DURAL HEMORRHAGE CASES.

CASE I. (Schneider, *Archiv für klin. Chir.*, 1887.)—Stab-wound in the left temporal region received during a fight. Lay unconscious for an hour, as if in a swoon; then recovered consciousness, but could not speak. Could hardly move his right arm, and his right leg moved but little. Four days later right facial paralysis; consciousness complete; answered questions correctly by signs with the left hand. Paralysis of the right arm and paresis of the right leg. Pupils normal. Pulse 60. Wound nearly healed. Paralysis of the right side increased, so that finally the right arm and leg were almost powerless. Temperature remained normal. Pulse was slow; consciousness clear.

On the ninth day trephined over Broca's convolution. Dura was non-pulsating, a bluish blood-clot showing through dura. On opening the dura and removing a small clot a moderate-sized artery spurted from the depth of the wound, which was tied with catgut. The pulse rose to 80 after the operation, and speech began to return on the third day. Moved the right arm on second day. The facial paralysis had not entirely disappeared in six months.

CASE II. (Ceci, *Deutsch. med. Zeitung*, 1887.)—A fall, and two months later paraplegia followed by left hemiplegia. Ten days later the tongue turned to the right. Thickness of speech. Involuntary micturition. Coma.

Trephined over the right fissure of Rolando. Sub-dural clot found. Grad-

ual and complete recovery. The diagnosis of a cerebral abscess was made before the operation.

Case III. (Armstrong, *Journ. Amer. Med. Assoc.*, 1887.)—A man, aged fifty-three years, received a blow on the left forehead with a brick. Wound of scalp. Three months later paresis of the right arm and leg. Chills and fever.

Trephined over the left frontal bone. Dura dark and non-pulsating. The incision of the dura allowed the escape of fluid blood. Motion of arm and leg returned the same day. Complete recovery.

Case IV. (Macewen, *Lancet*, August 11, 1888.)—A boy fell, bruising the face. Developed stupidity. On the sixth day convulsions began on the left side of the face, and extended to the left arm and leg. Consciousness continued. On the seventh day convulsions persisted and were accompanied by loss of consciousness.

Trephined over the centre of the right Rolandic fissure. A fissured fracture of the skull was found. The dura was dark-colored. When the dura was opened two ounces of fluid and clotted blood escaped. Recovery without incident.

Case V. (Ball, *British Medical Journal*, 1888.)—A man, aged twenty-six years. Ten days before entrance received a blow on the head with a penknife. Since the accident there had been difficulty in speaking and pain in the head. Cicatrix small and extending deeply through the left temporal muscle, but fully healed.

Examination found motor aphasia, word-blindness, and word-deafness, but no paralysis. Five days after entrance symptoms increased, and trephining was done. A penknife-wound was found through the left temporal bone, and the dura and brain found to have been penetrated. The wound in the dura was enlarged, in which process the posterior branch of the middle meningeal artery was cut. On dilating the sinus in the brain, dark colored blood clot escaped. More blood-clot was washed out by irrigation through a drainage-tube. Complete recovery interrupted by the recurrence of aphasia on the third day, due to the plugging of the drainage-tube.

Case VI. (Walker, *Medical Age*, 1888.)—A boy, aged eleven years, fell twenty feet, striking on his head. Unconscious for half an hour. Vomited frequently small quantities of blood. The next day appeared aphasia and occasional delirium. Two days later spasms of the left arm, with turning of the eyes to the left. Started when spoken to and tried to get out of bed. Third day hemiplegia present. Vision impaired. Aphasia complete.

Trephined over right parietal eminence. A fracture was found extending from just above the external auditory meatus to the parietal eminence. There was also found a transverse fracture through the middle of the squamous portion of the temporal bone. The depressed portion was elevated. Dura was found dark colored. Considerable hemorrhage. Clot was removed by irrigation. Motion of the arm and leg began to return in two days. Recovery in three weeks.

Case VII. (Owen, *British Medical Journal*, 1888.)—A boy, aged nine years, fell from a cart and was stunned. Drowsy, restless, and muttering. Five days later convulsions involving the right facial and suprahyoid muscles and extending into the right arm. He had nine of these convulsions during the day. Motor aphasia was present. On the sixth day the attack was severe, involving the right sterno-mastoid and diaphragm. On the seventh day aphasia and twitching.

Trephined over the centre of the fissure of Rolando on the left side. The dura was granular and bulging. Considerable dark blood escaped, and the edge of a solid clot was exposed in the lower portion of the opening. Another trephine was placed just below the first, and the clot was thoroughly exposed and removed. Recurrence of convulsions on the next day. On the second day the wound was opened. No clot was found under the dura, but the pia was bulging and covered with healthy granulations. The pia was opened and a little fluid blood escaped. Irrigation. Two slight convulsions the next night. No convulsions after this. Discharged well in one month.

Case VIII. (Matas, *New Orleans Med. and Surg. Journal*, 1889.)—A boy, aged

nineteen years, received a blow on the left side of the head with a heavy stick, and was knocked senseless, but recovered quickly and walked home. Several hours later became worse, was stupid and staggered. Two days after the injury was semi-conscious. The right arm and leg were paralyzed. There was anæsthesia of the upper and lower extremities. Temperature 99°, and pulse 78. Swelling of the scalp over left parietal region. Answered questions incoherently. On the third day became comatose.

Trephined over left parietal eminence. The bone was slightly indurated. The dura was bulging and dark in color. One drachm of blood aspirated through the dura with a hypodermic syringe, and considerable blood trickled from the holes made by the needle. Recovery in fifteen days after slight suppuration.

CASE IX. (Allingham, *Clinical Society Transactions*, pp. 22, 221.)—A man, aged forty years, fell from a tram-car. Did not remember the accident. The next day was drowsy. The following three days was drowsy and irritable. Pupils equal and reacted. No paralysis. On the sixth day more drowsy. Respiration labored and stertorous. Convulsions beginning on the left side of the face and extending to the neck, arm, and leg of the same side. Involuntary micturition. Pupils reacted slightly, and the right was a little larger than the left. No corneal reflex. Stertor increased and convulsions became more frequent.

Trephined on the right side over the fissure of Rolando. The middle meningeal artery, posterior branch, seen intact. Dura non-pulsating; a dark mass beneath it. The dura was incised and a large blood-clot removed. The clot extended as far as the finger could reach. The bleeding vessel ligated. Catgut sutures and drainage. The next day more rational. Could move the left leg, but not the arm. Recovery interrupted by retention of the wound-discharges and suppuration. Recovery complete in two months.

CASE X. (Mills, *Journ. Nervous and Mental Disease*, 1890.)—A woman, aged sixty years, received a blow on the head. Unconscious. Boggy area over the right parietal bone. The left pupil did not react. The right pupil small and fixed. Paresis of the left arm. Right arm rigid. No sensation in the lower extremities. Breathing stertorous and sometimes Cheyne-Stokes. Involuntary micturition and defecation. For two days the pulse was from 64 to 100, and the respiration 20. On the second day moved when pressure was made upon scalp. Unconsciousness. On the evening of the second day died.

Autopsy. Sub-dural clot five inches long and two and a quarter inches broad over the upper temporal lobe, extending under the left parietal and frontal bones. Clot over the left cerebellar hemisphere.

CASE XI. (Chiene, *Trans. American Surgical Association*, 1891.)—A man, aged forty-two years, fell from a cab and was stunned, but recovered and gave name and address. Next day conscious. Was dismissed from the hospital on the fifth day, but readmitted on the sixth day. On the sixth day he lay on the left side with legs drawn up. Twitching of left side and face, jaws set, pupils equal and reacting slightly. The arms spasmodically contracted, especially the left. The right arm used more than the left. Pulse 80. On the seventh day twitching of the left face, arm, and leg. On the following two days this twitching increased in frequency and severity.

On the tenth day trephined just in front of the lower end of the right fissure of Rolando. The dura did not pulsate and was bluish and bulging. The dura was incised, and dark fluid blood escaped. The pulse rose from 60 to 80. Rigor on the evening of the thirteenth day; otherwise convalescence was uninterrupted, and he went to work in three months.

CASE XII. (Duret, *Cong. Trans. de Chir., Paris*, 1891.)—A man, age not given, fell from a cart. Temporary unconsciousness, followed by headache. On the thirteenth day aphasia. Slight right brachial paresis. Slight elevation of temperature. Sensory paresis of the right side. No apparent lesion of scalp or skull.

Trephined on the twentieth day over Broca's convolution. Sub-dural blood-clot and fluid blood. Ligation of two branches of the middle men-

ingeal exposed by trephine and divided at operation. Spoke after two days. Aphasia gradually recovered. Died on the twenty-first day.

Autopsy. Congestion and œdema of the meninges over the whole surface of the encephalon.

Case XIII. (Homans and Walton, *Boston Medical and Surgical Journal*, 1891.)—A man, aged twenty-eight years, fell from a carriage and was stunned, but recovered. Pupils equal, reacted. Pulse 60. Respiration normal. Hæmatoma in the right parieto-occipital region. On the third day delirium, followed on the fourth day by stupor and aphasia. Twitching of the right arm and leg, followed later by twitching on the left side. Later spasms became general and tonic in character. Partial consciousness.

Trephined over speech-centre near the lower end of the left Rolandic fissure. Dura bulging, tense and opaque. Hemorrhage found extending about in all directions. Pia mater cloudy and black just behind the fissure of Rolando. Brain considerably lacerated. Recovery in three months.

Case XIV. (Elliot, *Massachusetts General Hospital Records*, vol. cclxxxi. p. 41.)—A man, aged forty-two years, fell twelve feet, striking an iron bar six feet from the ground. At entrance, pulse weak and 42 to the minute. Respiration stertorous. Right pupil unduly dilated. Moved the left arm and leg freely, but moved the right only occasionally.

Trephined in the right temporal region. Dura bulging, punctured. About half an ounce of blood spurted out under great pressure. Immediate relief to stertor. Pulse rose to 120. Pupils nearly normal and equal. Drainage. Nine hours later stertor, rapid pulse, cyanosis. Bronchi full of fluid. Died in fourteen hours.

Case XV. (Beach, *Massachusetts General Hospital Records*, vol. cclxxiv. p. 43.)—A man, aged thirty-two years, fell from a car-step, striking his head. Unconsciousness was immediate and complete. Cut over the left eye. Hemorrhage from the left ear. Pupils equal and react slightly. Bruise on occiput. On the third day convulsions. Eyes turned upward and to the right. The right side of face, arm, and leg clonic spasms. Cyanosis. Convulsions frequently repeated.

Trephined over the centre for right shoulder. Dura dark, bulging and non-pulsating. On opening the dura considerable fluid and clotted blood escaped and lacerated brain-substance. Some fresh hemorrhage. At the close of operation there was stertor; the pulse feeble, from 150 to 180. On the following day the convulsions returned. On the second day convulsions, coma, and death.

Case XVI. (A. T. Cabot, *Massachusetts General Hospital Records*, vol. cclvii. p. 214.)—Injury not known. Unconscious. Pupils equal, slightly contracted and reacting. Pulse full and slow. Respiration deep and regular. Bleeding from the right ear and left nostril. No paralysis. Œdema of the right occipital and post-parietal region, and a depression felt the size of a twenty-five cent piece. Ten hours later partially conscious. The following two days remained stupid, with conjugate deviation of the eyes to the right.

Trephined at the seat of the injury—that is, the upper posterior parietal region on the right side. Depression found less than one eighth of an inch. Blood clot from surface of dura. Dura non-pulsating. Four days later convulsions of the left arm, leg, and face. Dura opened, and about one and a half ounces of blood-clot removed, coming from the region of the fissure of Rolando. Dura sutured and skin wound closed. Two days later restless. On the third day spasms of the left side and face. On the fourth day restless, ptosis of the right eyelid, and dilatation of the left pupil. Convulsions of the left arm, leg, and face. Partially conscious in the afternoon. On the fourth day suddenly became comatose and died.

Case XVII. (C. B. Porter, *Massachusetts General Hospital Records*, vol. cclix. p. 166.)—A man, aged twenty-four years, was knocked down in the street. Conscious, but dull. Pupils equal and reacting. Twenty-four hours after the injury pulse slow. Swelling in the right lower occipital region. At the end of thirty-six hours increasing stupor. During the next two days improvement in the mental condition, and wanted to leave the hospital, and was discharged against advice. Four hours later brought back restless and delirious.

Convulsions of the left arm; head thrown back; right arm rigid. Respiration labored and stertorous, 30 to the minute. Right pupil dilated; left contracted and no reaction. Unconsciousness, coma; death four days after the injury.

Autopsy. Fissure in the right occipital fossa running into the foramen magnum. Small extra-dural clot in the right occipital fossa. Fissure running through the right occipital fossa across petrous portion of the temporal. Considerable sub-dural hemorrhage at the base of the left middle and anterior fossa. Laceration of brain.

CASE XVIII. (Wells, *N. Y. Medical Record*, May 14, 1892.)—Fell in the street. Unconsciousness was followed by frequent general convulsions. In three days convulsions became nearly constant. A small scar exposed on the left side of head above and in front of the ear.

Trephined under the scar and over the motor centres. Dura found adherent; no fracture, no depression. Dura dark, non-pulsating. On opening the dura a handful of clotted blood escaped, and the fissure of Rolando was exposed. Asked for a drink on coming out of ether. Recovery interrupted by occasional convulsions. Gave a history of a blow on the head three weeks before the present fall, followed only by severe headaches and weakness of the left arm and leg. Temperature 105° at the time of the operation. Blood-clot showed evidences of beginning breaking-down.

CASE XIX. (Bremer and Carson, AMERICAN JOURNAL OF THE MEDICAL SCIENCES, Phila., 1892.)—A man, aged twenty-one years, fell one story, but walked home. Temporary unconsciousness and fall one week later, then aphasia. Right facial paresis and tongue protruded to the right. Loss of sensation over the whole of the left side. Agraphia. Paresis of the right hand in about two weeks; this increased, and the right leg began to be involved. Dulness of mind.

Trephined one and a quarter inches behind the external angular process of the parietal bone, and a quarter of an inch above the base-line. Dura dark and cloudy, non-pulsating. A large amount of fluid and clotted blood under the anterior branch of the middle meningeal artery between the dura and arachnoid, which was flat and empty. On the fourth day recovered from aphasia. On the sixth day recovered from agraphia. Complete recovery in nineteen days. Hemorrhage in this case from the anterior main branch of the middle meningeal.

CASE XX. (Mynter, *Annals of Surgery*, 1894, pp. 19, 539.)—A man, aged twenty-five years, received a blow on the head with fist. Face and eyes swollen; severe pain in the back of head. On the twelfth day clonic spasms of right side of face and arm. Paresis of right side of face. Tongue drawn to the left. Left pupil contracted. Anæsthesia of face. Paresis of right arm and leg. Aphasia complete. Temperature normal. Pulse 96. On the thirteenth day could move right arm and leg, and seemed to understand questions, and to try to answer them. Restless. Pulse 120.

Trephined over speech and face centre. Dura bulging and bluish. On opening a stream of black blood spurted several feet into the air; three ounces evacuated. Clot three inches square and one-quarter inch thick. Brain then pulsated plainly, but appeared "compressed inward" and "excavated."

Sutured dura with catgut. Button replaced. No drainage. In two days said "yes" and "no," and in four days aphasia had disappeared. Paresis well in a week. Discharged well in four weeks, except for slight weakness of right hand.

CASE XXI. (Walker, *Cincinnati Lancet-Clinic*, June 17, 1893.)—A man, aged twenty-three years, received a blow on the left side of the head with a billiard cue. On the third day delirium. Right facial paralysis. Left pupil dilated and non-reacting. Involuntary micturition and defecation. Temperature normal. Scalp-wound two inches long on the left side of the head. Linear fracture of skull found under wound. Trephined under wound and dura found dark blue and bulging. A two-ounce blood-clot removed. Facial paralysis had disappeared on recovery from ether. On the eighth day hernia cerebri appeared and gradually increased to the size of a hen's egg. Hernia sloughed off in four weeks. Recovery in eight weeks.

NO. 1 MARLBOROUGH STREET, BOSTON, MASS.

II.

MIDDLE MENINGEAL HEMORRHAGE.

By G. L. Walton, M.D.,
of Boston.

The subject of middle meningeal hemorrhage has been exhaustively treated in the foregoing paper. There are, however, a few exceptional conditions, of importance from a diagnostic point of view, to which I would call attention.

In the first place, it should not be lost sight of that a sinus as well as an artery may be ruptured by wounds, as the following case (seen in consultation with Drs. Homan and Hildreth, fracture of the base with hemorrhage having been the probable diagnosis) illustrates:

Male, aged nineteen years, received a blow on the left jaw in a friendly sparring bout; reeled; became unconscious in a few minutes. Within four hours tonic rigidity in all extremities had appeared, preceded by restlessness. Pupils first dilated, then contracted; the left slightly larger. Clonic spasm of right hand added to rigidity. Respiration tertorous. Ankle-clonus. No bleeding from the nose or ears, or under he conjunctiva. Eyes deviated to the right; head turned somewhat to he left. On the fourth day twitching of the right eyelid and angle of the mouth; extremities relaxed and paralyzed; slight twitching of right hand and foot. Pulse at first 100, later 58 to 84. Temperature rose on sixth day to 106.4°, pulse to 130. Death on sixth day.

Autopsy by Dr. Swan. Surface of brain covered with extravasated blood under dura; most on left side and over occipital lobes. Middle fossa of skull contained several ounces of same, and base of brain covered with blood which extended into the vertebral canal. Small rent in left lateral sinus; no fracture.

To show that this is not a unique case, Dr. Pinkham, of Lynn, tells me that he found hemorrhage from the *longitudinal* sinus as cause of death following a blow received in a sparring contest in that city. He has not given me the details.

The next point to which I would allude is—

The hysteroid state. One factor in the diagnosis of hemorrhage, not mentioned in text-books, has impressed itself upon me, namely, the period of semi-consciousness which in certain subjects follows concussion and laceration, and gives rise to the suspicion of some more serious gross lesion, as hemorrhage. This condition is particularly likely to follow severe concussion in the case of young girls, though it also appears in adults, being by no means confined to patients previously disposed to hysteria. It seems rather the effect of profound shock and injury to brain substance. It may, perhaps, be regarded as allied to the genuine traumatic neuro-psychoses. The patient, say a young girl, receives a severe blow on the head; a period of true unconsciousness follows. There

is no bleeding from the nose or ears, no sub-conjunctival hemorrhage, no convulsive motion, no deviation of eyes or disturbance of pupils. The breathing is regular and of normal character. Notwithstanding the absence of other untoward symptoms, complete consciousness does not return for a number of days, or even weeks. There is apt to be in these cases retention of urine. After a number of days the question naturally presents itself, Have we not to do with a hemorrhage, and should not trephining be considered? The absence of all symptoms, excepting the unconsciousness, should lead to the suspicion that we have to do with a mental state, rather than with a gross lesion.

In one such case, carefully watched for days by Dr. Richardson, Dr. Mumford, and myself, the first suspicion of the true condition was aroused by the struggles of the patient against the introduction of the catheter and the involuntary flow of urine accompanying these struggles. This patient, after lying for a number of days in a condition of apparent unconsciousness, finally answered a question in a perfectly natural and petulant tone of voice, as if angry at being disturbed. Gradual recovery without unfavorable symptom followed, but it was some months before the balance was perfectly restored. In a somewhat similar case, called to my attention by the attending physician, typical hysterical hemi-anæsthesia followed a protracted period of unconsciousness which had caused great uneasiness and uncertainty of diagnosis.

Various mental conditions may follow this condition, among which refusal to talk is perhaps most frequent. This was the case in a patient in Dr. Mixter's service, seen by me in consultation. This patient, an adult, after having been struck by an engine, remained apparently unconscious for a considerable time without sign of gross lesion, with eyes sometimes held open, sometimes shut. He refused to answer questions for a long time. Whether there may or may not have been method in the subsequent mental state of this patient there can be little doubt that the trance-like condition at first observed was to be attributed to the blow.

Without referring to the medico-legal complications, which may add to the difficulties of analysis in these cases, I would simply emphasize the fact that hysteroid sub-consciousness supervening upon a blow is not to be mistaken for the deepening unconsciousness which indicates hemorrhage.

In the consideration of the collected cases the following are some of the points which have struck me as worth bearing in mind apart from the classical symptoms: Paralysis may occur without preceding convulsions. The interval of consciousness may be wanting. Rigidity may appear without preceding clonic convulsions. Bilateral rigidity does not necessarily point to hemorrhage at the base, nor even to a bilateral hemorrhage at the cortex, but may result from extensive unilateral

middle meningeal hemorrhage. In the latter case the onset will be, however, unilateral.

The prognosis of aphasia, as well as of hemiplegia, resulting from cortical hemorrhage, is generally good, if the effused blood be removed by operation, even though considerable laceration has taken place.

Three months is the longest interval on record between the time of receiving the injury alleged to be the cause of the hemorrhage and the onset of symptoms resulting from hemorrhage. (I have recently seen a case with Dr. Richardson, in which five weeks of apparent health intervened, followed by coma.)

Anæsthesia may result from cortical hemorrhage, but far less frequently and less marked than motor paralysis. Stertorous respiration, though a serious symptom, does not contra-indicate operation. Coma does not contra-indicate operation. The pupils may remain unaffected.

In the exceptional event that one arm be paralyzed and the other convulsed or rigid, other symptoms must be depended on for the location of the hemorrhage. In case the injury is on one side, and the symptoms on the same side, operate on the side indicated by the symptoms, rather than at the site of the blow.

Symptoms of fracture of the base added to those of middle meningeal hemorrhage render the prognosis unfavorable. Tonic rigidity may appear in parts previously paralyzed as regards voluntary motion.

If symptoms of hemorrhage are present and operation is undertaken at all, exploration should be thorough, certainly sufficient to expose the posterior branch of the middle meningeal artery. Diagnosis of the side of lesion may be made from paralysis of the third nerve alone, if general symptoms of hemorrhage are present. In case of bilateral convulsion a dilated and fixed pupil alone may indicate the side of hemorrhage. Deviation of the eyes and head, though important in corroboration, affords little help as a localizing symptom.

III.

LOCALIZED HEMORRHAGE BENEATH THE PIA MATER OVER THE UPPER THIRD OF THE ROLANDIC AREA, DUE TO A FALL ON THE HEAD:

LOCALIZED CONVULSIONS WITHOUT LOSS OF CONSCIOUSNESS; LATER, SLIGHT MENTAL CONFUSION WITH PARALYSIS OF THE AFFECTED LIMBS, FOLLOWED BY PROLONGED COMA AND DEATH.[1]

By James J. Putnam, M.D.,
of Boston, Mass.

The patient was a lady, seventy-two years old and of delicate health. The accident happened in the following manner: The house in which she lived was entered by a door at the top of four stone steps. Having walked up these steps she pulled the bell. The wire broke with her weight, and she fell backward onto the sidewalk. She was not fully stunned, however, and was able with some assistance to walk into the house and up a flight of stairs to her room. Dr. C. P. Putnam was called, but found her in good condition and discovered no signs of injury beyond a bruise and swelling of the scalp at the vertex. Later, I saw her a number of times in consultation. For twenty-four hours she seemed to be doing well. Then spasms began to occur in the left arm, and to a less degree in the left leg and the left side of the face. They were slight, of jerking character, not confined to any single segment, and not attended with loss of consciousness. These spasms recurred at short intervals during about two days. As they passed away the limbs became paretic and eventually paralyzed, and at the same time the patient's mental condition became disturbed. She grew somewhat talkative, but what she said was often irrelevant, the whole condition somewhat suggesting that of a person recovering from ether. Headache was scarcely complained of at all, and the pulse and temperature were unchanged or slightly increased. At the end of about two days more this state began to pass over into one of coma, which gradually deepened until her death, which occurred a few days later, or about ten days from the date of the accident. At no time did the pulse show the slowing usually supposed to attend compression. There was very little change in temperature at any period, but toward the day of her death it gradually rose to a slight degree.

The post-mortem was made by Dr. W. F. Whitney, twenty-one hours after death, in the presence of Dr. C. P. Putnam and myself, and the following notes with the accompanying sketches were made by me on the spot.

There was an extravasation of blood beneath the scalp covering the vertex and upper part of the occipital bone. The bone was not fractured. An extensive subdural hemorrhage covered the right hemisphere of the brain over its posterior half to near the point of the occipital por-

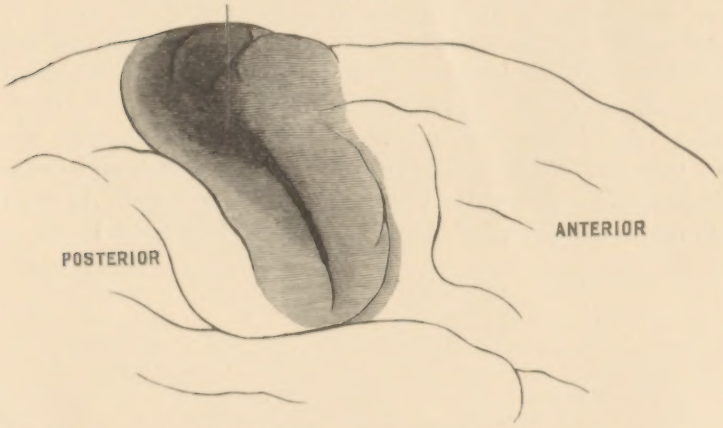
[1] Reported in connection with Dr. Scudder's paper.

tion. Besides this, a thick clot lay in the fissure of Rolando, at its upper portion, with the pia stretched smoothly over it. The central convolutions were forced apart by the clot at their upper end, and the anterior central especially had evidently been subjected to considerable pressure. The arteries at the base were highly atheromatous.

FIG. 4.

Represents a cross-section at the thickest part of the clot, parallel to the median fissure and close beside it.

FIG. 5.



Shows the tapering of the clot toward its lower end, and indicates that the neighboring convolutions were covered with a thin layer of blood.

The chief interest of this observation lies in the fact that the clinical features were somewhat different from those ordinarily seen in cases of hemorrhages of localized character, and in the indication furnished by the post-mortem, that an operation might perhaps have been done with benefit. It is almost needless to say that the propriety of operating was repeatedly discussed by my brother and myself as the different phases of the illness showed themselves, and had the signs of compression been more clear, or had the patient been younger and stronger, operation

would have been decided on. But the earlier symptoms seemed to point to laceration of the cortex more than to localized hemorrhage from the middle meningeal artery, and the later symptoms were of equivocal significance. The idea of a defined clot from the pial veins did not occur to us, but we did discuss the probability of extensive and spreading sub-dural hemorrhage, and decided against an operation to relieve it in view of the uncertainty of the diagnosis, the patient's age and naturally feeble condition, and the prostration induced by the accident. I do not even now think that we were wrong, and it is doubtful whether the recovery would have been complete at the time when it would have seemed justified by the urgency of the symptoms, even if the operation had been primarily successful.

With a younger patient the results would no doubt have been excellent.

The history of this case, as of so many others, shows the unreliability of the absence of "pressure-pulse" as disproving compression.

Symptoms of cerebral excitement have been observed in cases of hemorrhage involving the cortex, and are especially noted by Gowers in his *Diseases of the Nervous System.* In uncomplicated middle meningeal hemorrhage such symptoms must be rare, if they are ever observed, unless the dura is broken through. The occurrence of such an isolated, defined, and large pial hemorrhage as this must be very rare, and, as the case puzzled us, the report of it may help to solve a doubt for someone else. [Since this report was first made microscope sections have been prepared from the dura with its hemorrhage, and the existence of an old and vascular false membrane established. It was from these vessels that the sub-dural hemorrhage had occurred.]